REMARKS

Claim Rejections Under 35 USC §102 and 35 USC §103

Claims 34-37 have been rejected under 35 USC §102(b) as being anticipated by Akram et al. ('741).

Claims 38-40 have been rejected under 35 USC §102(b) as being anticipated by Wood et al. ('179).

Claim 39 has been rejected under 35 USC §103(a) as being unpatentable over Wood et al. ('179) in view of Akram et al. ('779).

Claims 41-42 have been rejected under 35 USC §103(a) as being unpatentable over Wood et al. ('179) in view of Akram et al. ('741).

Claims 43-47 have been rejected under 35 USC §103(a) as being unpatentable over Akram et al. ('741) in view of Akram et al. ('779), Hembree et al. ('174) and Wood et al. ('179).

Claims 48-51 have been rejected under 35 USC §102(b) as being anticipated by Akram et al. ('741) in view of Kucharek ('495) and Wood et al. ('179).

Claims 68-70 have been rejected under 35 USC §102(b) as being anticipated by Akram et al. ('741) in view of Wood et al. ('179) and Farnworth et al. ('428).

Claims 71-73 have been rejected under 35 USC §103(a) as being unpatentable over Akram et al. ('741) in view of Akram et al. ('779) and Wood et al. ('179).

Claims 75-77 have been rejected under 35 USC §103(a) as being unpatentable over Tuttle ('122) in view of Liu et al. (,439) and Hembree et al. ('174).

The rejections under 35 USC §102 and 35 USC §103 are respectfully traversed for the reasons to follow.

ARGUMENT

35 USC §102(b) Rejections Of Claims 34-37 Over Akram et al. ('741)

Independent claim 34 is directed to a method for fabricating an interconnect 10 (Figure 1) for a semiconductor die 22 (Figure 3) having a contact location 21 (Figure 3). The method includes the step of providing a substrate 12 (Figure 5A), and the step of forming a raised contact member 20 (Figure 5C) on the substrate 12 at least partially covered with a conductive layer 32 (Figure 5C) configured to electrically contact the contact location 21 (Figure 3).

Admittedly these first two steps are taught by Akram et al. ('741). In particular, Figure 14 of Akram et al. '741 illustrates a substrate 12, a contact member 65 on the substrate 12, and a metal silicide conductive layer 78A on the contact member 65. However, in Akram et al. ('741), conductive traces 80 are then formed on the substrate 12 in electrical communication with the conductive layers 78A using an etching process. Specifically, column 8, lines 10-25 of Akram et al. ('741) describes the thin film deposition and etching process for forming the conductive traces 80.

With the present process the conductors 18 (Figure 3) are contained on a polymer film 16 (Figure 3) which is formed separately and then attached to the substrate 12. The conductors 18 and the polymer film 16 are similar to conventional multi layered TAB tape used in semiconductor packaging. An advantage is provided over the thin film deposited and etched conductive traces 80 of Akram et al. '741, because the conductors 18 of the present application can be thicker, and can have a lower resistivity than the conductive traces 80 of Akram et al. '741. In addition, the polymer film 16 can include ground and voltage planes such that an impedance of the conductors 18 can be adjusted as required.

Independent claim 34 has been amended to recite the step of "providing a separate polymer film having a conductor

thereon". This step is intended to distinguish from the thin film deposited and etched conductive traces of Akram et al. '741.

Independent claim 34 also recites the step of "forming a conductive material on the substrate separate from the conductive layer and the conductor in electrical communication with the conductive layer and the conductor". The conductive material 28 is shown in Figure 3. In Akram et al. ('741) the conductive traces 80 make direct physical and electrical contact with the contact members 65 (See Figure 14) such that the above limitations of a separate conductive material 28 are not met. With the present method, the separate conductive material 28 provides an improved interconnect because an expansion joint is provided. In particular, as stated at page 6, lines 21-24 of the specification: "The conductive material in addition to forming an electrical path, also functions as an expansion joint, to accommodate thermal expansion of the conductors without stressing the contact members." Independent claims 34 has also been amended to state that the conductive material is "configured to provide an expansion joint between the contact member and the conductor."

In view of the above differences, amended independent claim 34, and dependent claims 35-37, are submitted to be both novel and unobvious over Akram et al. ('741).

Dependent claim 35 recites a further limitation of the conductor comprising a "copper foil laminated to the polymer film". In this regard, the Office Action has cited column 7, line 37 and lines 42-54 of Akram et al. as anticipating this feature. This interpretation is submitted to be incorrect, as the cited passage teaches a sintering process for forming metal silicide layer 78A (Figure 14).

Dependent claim 36 recites a further limitation of the "conductive material comprises a conductive adhesive material". In this regard, the Office Action has cited column 1, line 31 of Akram et al. as anticipating this

feature. This interpretation is also submitted to be incorrect, as the cited passage teaches a bonding process for attaching dice to a substrate using an adhesive. The bonding process does not employ a conductive adhesive, and does not form an expansion joint between a contact member and a conductor as presently claimed.

Dependent claim 37 recites a further limitation of the "conductive material comprises a solder material". In this regard the Office Action has cited column 37, line 34-44 of Akram et al. as anticipating this feature. This interpretation is also submitted to be incorrect, as the cited passage teaches a wire bonding process for attaching bond wires 82 (Figure 14) to the conductive traces 80. In addition, the soldered bond wires do not form an expansion joint between a contact member and a conductor as presently claimed.

35 USC §102(b) Rejections Of Claims 38-40 Over Wood et al. ('179)

Amended independent claim 38 recites essentially the same steps as independent claim 34 and recites the step of "providing a tape comprising a polymer film and a plurality of conductors on the film". Independent claim 38 also recites the feature of the tape 14 (Figure 4) having "openings" 26 (Figure 4) and the contact members 20 (Figure 4) "extending through the openings" 26.

In support of the 35 USC §102 rejections, the Examiner has cited column 8, lines 6-8 of Wood et al. ('179) as teaching a tape. However, the tape described in the above cited passage is an electrically insulating (column 7, lines 67) adhesive tape (column 8, line 6) applied to a cover 21 (Figure 5A). It is not a tape containing conductors as presently claimed, and is not attached to a substrate for an interconnect as presently claimed. The Examiner has further cited the opening 92 (Figure 2) in Wood et al. ('179) as anticipating the present openings 26 (Figure 4) that are aligned with the contact members 20 (Figure 4). However, the

opening 92 in Wood et al. ('179) is in the cover 73 (Figure 2), and functions to provide access for a vacuum device (column 8, lines 17-20). The opening 92 in Wood et al. ('179) thus has a different structure and function than openings in a polymer film aligned with contact members and containing a conductive material as presently claimed.

Further, Wood et al. ('179) discloses circuit traces 27 that connect directly to the bondpad contacts 31 (See Figure 4). As such, there is no conductive material in an opening configured to provide an expansion joint as presently claimed in independent claim 38.

In view of these fundamental differences claims 38-41 are submitted to be both novel and unobvious over Wood et al. ('179). Also with respect to dependent claim 40, the conductive adhesive taught at column 3, lines 63-64 of Wood et al. ('179), is a connection to a die in a package or multi chip module, and is not an expansion joint between a conductor and a contact member as presently claimed.

35 USC §103(b) Rejections Of Claim 39 Over Wood et al. ('179) In View Of Akram et al. ('779)

Dependent claim 39 recites the step of forming the contact members by "etching the substrate to form pillars and then depositing conductive layers on the pillars". Akram et al. ('779) was cited as anticipating this step. Admittedly, etched contact members are known in the art. However, claim 39 is submitted to be unobvious over the combination of Wood et al. ('179) and Akram et al. ('741) because of the differences noted above for the 35 USC §102 rejections based on Wood et al. ('179). Specifically, Wood et al. ('179) does not teach a polymer tape with conductors, openings in the polymer tape aligned with contact members, and a conductive material in the openings configured as expansion joints.

35 USC §103(b) Rejections Of Claims 41-42 Over Wood et al. ('179) In View Of Akram et al. ('741)

Claims 41-42 are submitted to be unobvious over the combination of Wood et al. ('179) and Akram et al. ('741) because of the differences noted above for the 35 USC §102 rejections based on Wood et al. ('179). Specifically, Wood et al. ('179) does not teach a polymer tape with conductors, openings in the polymer tape aligned with contact members, and a conductive material in the openings configured as expansion joints.

With respect to Akram et al. ('741) this reference does not teach the use of solder as expansion joints, and does not teach separate conductors on a polymer tape containing openings for the expansion joints.

In view of these fundamental differences, claims 41-42 are submitted to be unobvious over the cited combination of Wood et al. ('179) and Akram et al. ('741).

35 USC §103(b) Rejections Of Claims 43-47 Over Akram et al. ('741) in view of Akram et al. ('779), Hembree et al. ('174) and Wood et al. ('179)

Amended independent claim 43 contains recitations similar to claim 38, and also states that the contact member comprises a base, a pillar and a projection. Admittedly, Akram et al. ('741) and Akram et al. ('779) teach this type of contact member. However, the steps of providing a separate polymer tape with a conductor, attaching the tape to the substrate, and then electrically connecting the contact member to the conductor with a conductive material configured as an expansion joint, are not taught be either of these references. In addition, as previously argued Wood et al. ('179) also does not teach these features.

Hembree et al. ('174) was cited as teaching the step of providing and attaching a tape containing a conductor to a substrate. However, the tape referred to at column 4, line 31 of Hembree et al. ('174) is for attaching the die 24 to the package lid structure 30. As such, the tape of Hembree

et al. ('174) performs an attachment function, rather than being an electrically conductive element as presently claimed.

In view of these differences, claims 43-47 are submitted to be unobvious over the cited combination of references. Also with respect to dependent claims 44-47, as previously argued, the features in these claims are not taught by the cited art.

35 USC §102(b) Rejections Of Claims 48-51 Over Akram et al. ('741) in view of Kucharek ('495) and Wood et al. ('179)

The rejections of claims 48-51 over the above combination of references is traversed as being invalid on its face. In support of the 35 USC §102 rejections, the Examiner has combined several references. However, a proper 35 USC §102 rejection must be based on a single reference, or on a single reference combined with knowledge of the person of ordinary skill in the art. As stated in Connell v. Sears, Roebuck & Co., 722 F.2d 1542, 220 U.S.P.Q. 193 (November 23, 1983): "anticipation requires the presence in a single prior art disclosure of all elements of a claimed invention as in the claim."

Similarly, as stated in MPEP 706.02(a): "for anticipation under 35 USC §102, the reference must teach every aspect of the claimed invention either explicitly or implicitly. Any feature not directly taught must be inherently present."

35 USC §102(b) Rejections Of Claims 68-70 Over Akram et al. ('741) in view of Wood et al. ('179) and Farnworth et al. ('428)

The 35 USC §102(b) rejections of claim 68-70 are traversed for the same reasons as stated above for claims 48-51. Specifically, a proper 35 USC §102 rejection must be based on a single reference, or on a single reference combined with knowledge of the person of ordinary skill in the art.

35 USC §103(b) Rejections Of Claims 71-73 Over Akram et al. ('741) in view of Akram et al. ('779) and Wood et al. ('179)

Independent claim 71 defines a system for testing a semiconductor die rather than a method. However, claim 71 includes recitations similar to independent claims 34 and 38. Specifically claim 71 recites a separate polymer tape having a conductor, and a separate conductive material configured to form an expansion joint. As previously argued these features are not taught by the above cited combination of references.

35 USC §103(b) Rejections Of Claim 74 Over Akram et al. ('741) in view of Kucharek ('495), Farnworth et al. ('428) and Wood et al. ('179)

Independent claim 74 also defines a system for testing semiconductor dice, but with a depression for retaining bumped contact locations on the dice. Kucharek et al. ('495) was cited as teaching a depression with a conductive layer for retaining bumped contacts. Although this feature is known in the art, the cited passage of Kucharek et al. ('495) (column 17, lines 66-68 to column 8, line 6) deals with flip chip bonding of bumped dice.

In addition, the cited combination of references does not teach an interconnect which comprises a conductor on a separate polymer film having an opening which surrounds the depression. Accordingly, claim 74 is submitted to be unobvious over the cited combination of Akram et al. ('741), Kucharek ('495), Farnworth et al. ('428) and Wood et al. ('179).

35 USC §103(b) Rejections Of Claims 75-77 Over Tuttle ('122) in view of Liu et al. ('439) and Hembree et al. ('174)

Claims 75-77 have been canceled.

Conclusion

In view of the above arguments and amendments, favorable consideration and allowance of claims 34-51 and 68-74 is requested. Should any issues remain, the Examiner is asked to contact the undersigned by telephone.

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September 6, 2001
Date of Signature

Stephen A. Gratton
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Marked Version Of Amended Claims Showing Changes

34. (twice amended) A method for fabricating an interconnect for a semiconductor die having a contact location comprising:

providing a substrate;

forming a raised contact member [comprising a raised portion of] on the substrate at least partially covered with a conductive layer and configured to electrically contact [a] the contact location [on the die];

providing a separate polymer film having a conductor thereon;

attaching the polymer film [a metal conductor] to the substrate with at least a portion of the conductor located proximate to the contact member; and

forming a conductive material on the substrate separate from the conductive layer and the conductor in electrical communication with the conductive layer and the conductor and configured to provide an expansion joint between the contact member and the conductor.

35. (twice amended) The method of claim 34 wherein the [metal] conductor comprises a copper foil laminated to [a] the polymer film.

36. (twice amended) The method of claim 34 wherein the conductive material comprises a conductive adhesive material.

37. (twice amended) The method of claim 34 wherein the conductive material comprises a solder material.

38. (twice amended) A method for fabricating an interconnect for a semiconductor die having a plurality of contact locations, comprising:

providing a substrate;

forming a plurality of contact members on the substrate configured to electrically contact [a plurality of] the contact locations; [on the die;]

providing a tape comprising a polymer film and a plurality of conductors on the film including a plurality of openings configured for placement on the contact members;

attaching the tape to the substrate with the contact members projecting through the openings; and

depositing a conductive material in the openings in electrical communication with the contact members and the conductors and configured to provide expansion joints therebetween.

39. (twice amended) The method of claim 38 wherein the forming the contact members step comprises etching the substrate to form pillars and then depositing conductive layers on the pillars.

40. (twice amended) The method of claim 38 wherein the conductive material comprises a conductive adhesive material.

41. (twice amended) The method of claim 38 wherein the conductive material comprises a solder material.

42. (twice amended) The method of claim 38 wherein the conductors comprise a metal foil laminated to the polymer film.

43. (twice amended) A method for forming an interconnect for a semiconductor die having a contact location, comprising:

providing a substrate;

forming a contact member on the substrate comprising a base, a pillar and a projection configured to penetrate [a] the contact location [on the die] to a limited penetration depth;

providing a separate multi layered tape comprising a polymer film and a metal conductor [formed thereon] on the film;

attaching the tape to the substrate with at least a portion of the conductor located proximate to the contact member; and

electrically connecting the contact member to the conductor by depositing a conductive material on the contact member and on the conductor configured to form an expansion joint therebetween.

44. (twice amended) The method of claim 43 wherein the conductor [includes] has an opening therein aligned with the contact member and the conductive material is deposited in the opening.

45. (twice amended) The method of claim 43 wherein the conductive material comprises a conductive adhesive material.

46. (twice amended) The method of claim 43 wherein the conductive material comprises a solder material.

47. (twice amended) The method of claim 43 wherein the attaching the tape to the substrate step comprises forming an adhesive layer between the tape and the substrate.

48. (twice amended) A method for forming an interconnect for a semiconductor die having a bumped contact location, comprising:

providing a substrate;

forming a depression in the substrate sized to retain [a] the bumped contact location [on the die];

covering at least a portion of the depression with a conductive layer; [and]

providing a separate conductor having an opening therein; and

attaching [a] the conductor to the substrate with the opening surrounding the depression, and the conductor in electrical communication with the conductive layer and electrically insulated from the substrate.

49. (twice amended) The method of claim 48 wherein the attaching step comprises forming an electrically insulating adhesive layer between the conductor and the substrate. [conductor includes an opening surrounding the depression.]

50. (twice amended) The method of claim 48 wherein the conductor comprises a metal foil [laminated] attached to a polymer film.

51. (twice amended) The method of claim 48 wherein the attaching the conductor step comprises forming an adhesive layer between the conductor and the substrate.

68. (amended) A method for fabricating an interconnect for a semiconductor die having a contact location, comprising:

providing a substrate;

forming a plurality of contact members on the substrate comprising conductive layers configured to electrically contact [a plurality of] the contact locations [on the die];

providing a separate polymer film [with] having a plurality of conductors thereon [, the conductors including] with a plurality of openings configured for placement on the contact members;

attaching the tape to the substrate with the openings substantially enclosing the contact members; and

depositing a conductive material in the openings in electrical communication with the conductive layers and the conductors configured to form expansion joints therebetween.

69. (amended) The method of claim 68 wherein the contact members comprise raised portions of the substrate at least partially covered [with] by the conductive layers.

70. (amended) The method of claim 68 wherein the contact members comprise depressions in the substrate at least partially covered [with] by the conductive layers.

71. (amended) A system for testing a semiconductor die having a contact location comprising:

a temporary package for the die; and

an interconnect on the package for establishing temporary electrical communication with the die;

the interconnect comprising:

a substrate,

a contact member comprising a [pillar formed integrally with the substrate, and a] conductive layer [formed thereon] configured to electrically contact [a] the contact location [on the die];

a multi layered tape bonded to the substrate comprising a polymer film and a conductor on the polymer film; and

a conductive material on the substrate separate from the conductive layer and the conductor in electrical communication with the conductive layer and the conductor and configured to form an expansion joint therebetween.

72. (amended) The system of claim 71 wherein the conductor comprises a metal foil [laminated] attached to the polymer film.

73. (amended) The system of claim 71 wherein the conductive material comprises a conductive adhesive material or a solder material.

74. (amended) A system for testing a semiconductor die <u>having a bumped contact location</u> comprising:

a temporary package for the die; and

an interconnect on the package for establishing temporary electrical communication with the die;

the interconnect comprising:

a substrate;

a depression in the substrate configured to retain [a] <u>the</u> bumped contact location [on the die];

a conductive layer at least partially covering the depression;

a <u>separate</u> tape attached to the substrate comprising a polymer film and a conductor on the polymer film with an opening [proximate to] <u>substantially surrounding</u> the depression; and

a conductive material on the substrate <u>separate from the conductor and the conductive layer</u> electrically connecting the conductive layer and the conductor.